

## CLAIMS

The invention claimed is:

1. A method of correlating a signal comprising the steps of:
  - 5 (a) selecting a plurality of samples of said signal;
  - (b) modifying a first butterfly transform with a first twiddle factor;
  - (c) transforming said samples with said modified first butterfly transform;
  - (d) modifying a second butterfly transform with a second twiddle factor;
  - 10 (e) transforming an output of said of said first butterfly transform with said modified second butterfly transform;
  - (f) modifying a third butterfly transform with a third twiddle factor;
  - (g) transforming an output of said second butterfly transform with said modified third butterfly transform;
  - 15 (h) selecting a largest output of said third butterfly transform; and
  - (i) repeating steps (a) - (h) for a plurality of values of said first, said second, and said third twiddle factors.
2. The method of claim 1 wherein a value of said first, said second and said third  
20 twiddle factors are selected from a twiddle factor set comprising values 0,  $\pi/8$ ,  $\pi/4$ , and  $3\pi/8$ .
3. The method of claim 1 wherein the step of selecting a largest output of said third butterfly transform comprises the steps of:
  - 25 (a) storing a first output of said third butterfly transform;
  - (b) comparing a second output of said third butterfly transform to said stored first output; and
  - (c) replacing said stored first output with said second output if said second output is larger than said stored first output.

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4. A method of correlating a signal comprising the steps of:
- (a) selecting a plurality of samples of said signal;
  - (b) modifying said samples with a function of a first twiddle factor;
  - (c) transforming said samples with a first butterfly transform;
  - 5 (d) modifying an output of said first butterfly transform with a function of a second twiddle factor;
  - (e) transforming said modified first butterfly output with a second butterfly transform;
  - (f) modifying an output of said second butterfly transform with a function of a third twiddle factor;
  - 10 (g) transforming said modified second butterfly output with a third butterfly transform;
  - (h) selecting a largest output of said third butterfly transform; and
  - (i) repeating steps (a) - (h) for a plurality of values of said first, said second, and said third twiddle factors.
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5. The method of claim 4 wherein a value of said first, said second and said third twiddle factors are selected from a twiddle factor set comprising values 0,  $\pi/8$ ,  $\pi/4$ , and  $3\pi/8$ .
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6. The method of claim 4 wherein the step of selecting a largest output of said third butterfly transform comprises the steps of:
- (a) storing a first output of said third butterfly transform;
  - (b) comparing a second output of said third butterfly transform to said stored first output; and
  - 25 (c) replacing said stored first output with said second output if said second output is larger than said stored first output.
7. A correlator for a direct sequence spread spectrum signal comprising:
- 30 (a) a weighting device to modify a sample of said signal as a function of a

- first twiddle factor;
- (b) a first butterfly processor transforming a pair of modified samples of said signal;
- (c) a second weighting device to modify an output of said first butterfly processor as a function of a second twiddle factor;
- (d) a second butterfly processor transforming said modified output of said first butterfly processor;
- (e) a third weighting device to modify an output of said second butterfly processor as a function of a third twiddle factor;
- (f) a third butterfly processor transforming said weighted output of said second butterfly processor;
- (g) a largest modulus selector to identify a largest output of said third butterfly processor; and
- (h) a twiddle factor indexer successively varying a value of at least one of said first, said second, and said third twiddle factors.
8. The apparatus of claim 7 wherein said twiddle factor indexer varies a value of at least one of said first, said second and said third twiddle factors with one of a value selected from a twiddle factor set comprising values  $0$ ,  $\pi/8$ ,  $\pi/4$ , and  $3\pi/8$ .
9. The apparatus of claim 7 wherein said largest modulus selector comprises:
- (a) a comparator for comparing a first and a second output of said third butterfly processor; and
- (b) a register for storing a largest of said first and said second outputs of said third butterfly processor.
10. A correlator for a direct sequence spread spectrum signal comprising:
- (a) a first butterfly processor transforming a pair of samples of said signal as a function of a first twiddle factor;

- (b) a second butterfly processor transforming an output of said first butterfly processor as a function of a second twiddle factor;
- (c) a third butterfly processor transforming an output of said second butterfly processor as a function of a third twiddle factor;
- 5 (d) a largest modulus selector to identify a largest output of said third butterfly processor; and
- (e) a twiddle factor indexer varying in succession a value of at least one of said first, said second, and said third twiddle factors.

10 11. The apparatus of claim 10 wherein said twiddle factor indexer varies a value of at least one of said first, said second and said third twiddle factors with one of a value selected from a twiddle factor set comprising values 0,  $\pi/8$ ,  $\pi/4$ , and  $3\pi/8$ .

15 12. The apparatus of claim 10 wherein said largest modulus selector comprises:

- (a) a comparator for comparing a first and a second output of said third butterfly processor; and
- (b) a register for storing a largest of said first and said second outputs of said third butterfly processor.